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AN INTRODUCTION TO SYSTEMS PSYCHOLOGY

This is intended to be an introduction to a little-known, and perhaps new, psychological theory. It may not be a theory; it may only be a point of view. For the present purposes it will be called "Systems Psychology," but it should be understood that this is a provisional term, subject to change.

More importantly, it should be understood that this is a unified and distinct point of view: distinct from Freudian theory, other psychoanalytic theories, behavioristic or S-R theories, and such other minority viewpoints as Gestalt psychology, Existential psychology, group-dynamic psychology, topological psychology, and Parsons' Theory of Social Systems (with which it should not be confused.) But naturally this remark is just a loophole — as a psychological point of view Systems Psychology must stand ready to accept what is correct in these others.

In its current form, Systems Psychology is a point of view stemming chiefly from a point of view which began in economics, and military procurement engineering - the "systems approach." I point out that the systems approach began in economics, engineering and military procurement because it should not be thought that as a viewpoint it is intrinsically related to any of these fields. Moreover, most of its practitioners in these fields would not recognize this version of it. Nor would they be likely to understand, or subscribe to, my contention that it is applicable to many other areas. These remarks are intended to set the reader straight

as to whether Systems Psychology is in the main stream of things. The answer is yes and no. The systems approach, and systems analysis, are important new concepts and points of view. However, to my knowledge they have not been formally introduced under those names into any branches of philosophy or the social sciences. (However, there has been a move, under such persons as Rapoport and von Bertalanffy, to found an interdisciplinary field called General Systems Theory. This, too, is something else again.)

For the present purposes, anyway, we will use the term Systems Psychology for a viewpoint in psychological theory to be described in this paper. It is called "systems psychology:" 1) because it involves several kinds of whole interacting fields, which must be considered as systems; 2) because it sometimes requires the examination of sets of practices and how well these practices do what is wanted, which is one important phase of systems analysis and the systems approach in the fields where they originated. 3) Besides these aspects of systems analysis, Systems Psychology as a point of view also incorporates the Theory of Strategy as developed by T.C. Schelling-- which is historically connected to "systems analysis" as previously used in economics, engineering and military procurement. However, this is merely a historical connection, and scarcely relevant to the continued connection of these two theories.

It is not easy to make a whole school of thought clear in one brief paper. This is particularly true of a school of thought which is completely undeveloped, and which must use as its sources disparate writings from many areas and fields previously considered unrelated. However, there are also these advantages: readers all begin together, and there is no historical clutter of Important Literature to be cited and summarized. All that need be done is to state the essentials-- if this is possible for a theorist still feeling his way.

Systems Psychology is a collection of perhaps a dozen ways of looking at things-- mind you, at <u>things</u>-- which, when combined, complement each other well and provide an integrated and extremely general viewpoint. I will first list them all and describe them briefly, and then try to expound them in sufficient detail, with their interrelationships, to make clear their generality and possible application. That will be the entire scope of the present paper. No detailed applications will be attempted, nor will any attempt be made at the present time to clarify the relation of this viewpoint to other schools of psychology./ That is work for another day, or decade.

Nor will any attempt be made to describe possible research toward verifying and validating this point of view, let alone vindicating it as still another expeditionary force, provisional colonizing expedition into the vast wasteland of psychology.

~~1 and 2~~.

The most basic distinction in Systems Psychology is the distinction between Strategic Theory (~~X~~ the Theory of Strategy) and the Theory of Reactive Structures. This distinction is fundamental to this point of view, ~~fwwwwwwww~~ and I do not believe~~x~~ it has ever been made before. Much of the theory derives directly from it. Consequently, if this distinction ~~hadx~~ been made before, much of this theory would have appeared before, and I do not believe that ~~id~~ has.

1. Strategic theory is theory about strategy. Strategy is a part of any behavior which involves calculating the consequences of your actions. It is a part of the behavior; it is not necessarily the behavior, or the calculation itself. Nor need the calculation occur. ~~Ix fwwwwwwwwwwwwwwwwwwwww~~ For example, trying to decide whether to eat lunch or not is a strategic question; trying to decide whether to wear a loud necktie to a cocktail party is a strategic question. However, the first question is of a kind we will for the present purposes call "trivial": and it can presumably be settled on simple utilitarian grounds the reaction of others need not be taken into account,/ The question of the necktie is more complicated, since there are others whose reactions must be considered.

Now "strategy" has several aspects in any situation. The most obvious is those calculations (including predictions) which the participants actually make. Let ~~xx~~ us call this the internal, or calculative, component. However, there are also the actual strategic features of the situation: for instance, whether I or the other fellow has the legal right-of-way at the intersection; whether I can actually pay ~~fxx~~ a check if my luncheon partner agrees to let me;

whether an assailant has a gun or a knife; whether a bank robber says he has a gun, or shows a gun. Let us call these real circumstances the situational component of strategy. Note that information is an important part of the situational component of strategy. For instance, suppose we wish to rescue a man lost in a mountain range, and we know just where he is because he has a radio transmitter. However, he has no radio receiver. We cannot give him information the way he can give us information, and so he cannot be told that rescue parties are on the way, etc. This is in the situation; it is an informational component of strategy. Similarly, suppose a friend of yours is somewhat deaf. You make a remark from behind him, in a conversational tone, and he does not respond. Is he ignoring the remark, or did he not hear it? Your uncertainty derives from situational strategic circumstances. Furthermore, your deaf friend may know that you cannot be sure he has heard something. This, too, is a situational component. You may know that he knows you cannot be sure; and so on.

There may be certain immediate objections to this form of analysis. One is that individuals' calculations and predictions about a situation may be quite different. Another is that what two people understand the situation to be may vary considerably, and what I think are the situational components may be quite different from what you think are the situational components. These ob-

jections are closely related and quite reasonable. However, they merely serve to introduce complications to the model, which we cannot deal with till much later.

In any case, for stragegy to be relevant to behavior it is not necessary for any calculation to take place. It is sufficient/for a) situations to have strategic aspects, and b) for at least one participant in the situation to be capable of responding to these strategic elements. No one needs to be capable of any sort of "calculation." For instance, many animals posture themselves threateningly when another similar animal approaches; the other then often retreats. This is a strategic occurrence. We do not assume that fish or spiders are calculating, they are probably just responding. But they are responding the way a calculating being would. Most creatures are endowed by nature with a certain disposition to strategic responding. Insofar as this follows patterns which would be relevant to calculating beings under certain circumstances, strategic analysis is relevant to understanding them.

2. This brings us to the second area of Systems Psychology, that which it is so important to distinguish from Strategic Theory. This we shall call Reactive Structure Theory.

Reactive Structure Theory deals with reactive structures. Reactive structures are systems of response, arrangements of reactions. Reactive structures are the sets of responses, often quite complex, that will occur under specifiable circumstances in a specifiable domain. Thus mice and mousetraps may be said to have reactive structures; but not just individual mice and mousetraps. A group of mice may be said to have a particular reactive structure, if, e.g., they can all be made to panic by shaking their platform, or to fight in specifiable ways by adjusting their diet. Similarly a box full of mousetraps, all set, will have a specific kind of reactive structure if, say, you drop another mousetrap into the box: that is they, will go off, jump around, and set each other off, probably until most have snapped. Moreover, putting a mouse in a room with a baited mousetrap also sets up a reactive structure: the mouse will tend to go for the cheese, and the trap will tend to snap. By "reactive structure" I mean the different kinds of responses that are built into the situation, and their interrelationships.

It will be noted that a thing need not be alive, let alone calculating, to have a reactive structure. The reactive structure is the way that certain events in the domain will be followed by other events. (We will not in general say "tend to be followed," since that would blur the model, but at the outset we will insist parenthetically that such a modification to probabilistic terms is easily possible and does not in any way damage it.)

The Theory of Reactive Structures, then, is roughly the same thing as a rather new field which has developed in and about engineering and computer science: the Theory of Automata. The Theory of Automata deals with what an automaton (any particular given construction) will do. (Such studies are carried on either theoretically, from a consideration of the automaton's parts, or experimentally, actually constructing the automaton or its analog and studying what it does under specified circumstances.) Such studies have been carried on with machines which "learn," machines which "reproduce" themselves, machines which combine to form greater machines, and so on.

However, the Theory of Automata in its present development appears to presuppose that a thing is dead. The Theory of Reactive Structures is explicitly intended to have reference to living as well as non-living creatures; hence I will use the different term, in order to be sure of having it mean what I want it to mean.

It should be seen, then, that if we employ this terminology, most psychological theories are theories of reactive structure, and its acquisition. S-R theory treats behavior as the outcome of reactive patterns which are implanted by previous experience, according to principles which they consider to be ascertainable at least in principle. Freudian theory, at the other pole, considers human behavior to be a system of emotions and behaviors which are engendered chiefly by family and authority patterns. (Not only the individual persons, in Freudian theory, but also the sub-individual "persons"-- ego, id and so on-- may be considered to be reactive structures.) However, certain elements of Freudian theory may also be said to be strategic: the designing, tyrannical infant, for example, and the threatening, tyrannical father. (In the trivial sense the mother's behavior, too is strategic, in the trivial sense that she tends to like nurturing the infant, and consequently does what she likes, which is strategic behavior.) Sometimes, however, in Freud and other writers, terminology is employed which makes it seem that they consider these sub-individual entities to be actually performing strategic calculations. This is especially incredible to outsiders. However, for the present purposes we are going to ignore strategic theory where it occurs admixed with other problems in other schools of thought, and try to develop it from the ground up; <u>then</u> attempt to interrelate it with reactive structure, wherever we find this practical.

It will be clear that the relationship between "strategy" and "reactive structure" has many delicate points. The basic distinction is obvious and crucial: the theory of strategy deals with situations and actions in which calculation is relevant; reactive structure deals with behavior which is automatic, and thus where calculation does not occur. But, as I have already pointed out, certain forms of "strategic" behavior are built into some creatures as reactive structure. Moreover, adherents of Learning Theory would be quick to point out that strategic behavior for even the most calculating individuals is learned;(or, if they will concede that much of it is not "learned" but figured out, it will be "figured out" on the basis of learned experiences, etc.) Thus strategy can be "reduced to" reactive structure, according to one relatively conventional point of view.

3. If reactive structures, then, are individual components of response and response interaction, let us introduce another term to describe what happens in entire domains of reactive structures. For this I will use the phrase "reactive ecology."

Partly owing to the ambiguity of its Greek roots, the word "ecology" is somewhat ambiguous. The "eco-" has in one sense come to mean the arrangement of houses, patterns of settlement and the extent of civilization; hence "economics" (originally meaning household budgeting,) "human ecology" (the spatial patterns and trends in cities, and the arrangements and situations that cause them,) and the words "ecumen" and "ex oikumene" (the last a nonce-word of A.L. Kroeber./?/) However, in biology "ecology" refers to the systems of interrelationships among and around living things. It is this sense which I wish to introduce here. While "synecology" is sometimes used to preserve the distinction between spatial distributions and whole environments, it is just too long a word for this purpose.

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Reactive ecology is the term which embraces the outcomes of combining different reactive structures: for example, putting a number of creatures together on a given island, or in a goldfish bowl; putting connecting a group of machines in a certain way; and so forth. (As with "reactive structure," we will assume in our examples that outcomes are determinate, hope the reader will bear with us, and assert that in principle the concept can be broadened to handle whatever kinds of uncertainty are appropriate to real application.)

A number of things are of interest in reactive ecology. First, the outcomes themselves may be important to us for various private reasons, or for reasons based on the intrinsic interest of the domain or its elements.

Secondly, and more important from a theoretical point of view, interactions in a reactive-ecological domain may be studied for their patterning. Let me set forth some reactive-ecological terms, and then name certain patternings of reactive ecology which we ought to be able to recognize.

First, we will assume that in any reactive ecology there is some sort of physical base: the physical circuits of a computer, for instance, or the neural connections and bodily anatomy of living creatures. We will call these the physical base or elements of that reactive ecology. When events occur in the reactive structures, we may often assume it is because of some particular physical state in the physical base of these reactive structures-- for instance, the tension in a mousetrap's spring-- but these particularities will not be important to us.

Reactive structure analysis concerns itself, rather, with states, events, reactions, and patterns of any of these. A "state" is any particular condition in the domain. If the domain is a mousetrap, we might wish to distinguish two states, cocked and sprung. Or we might wish to distinguish among three different "sprung" conditions, state A in which there is no mouse around, state B where a mouse has been killed in the trap, and state C where the trap is sprung but the mouse is unharmed.

An event is anything which occurs between two states. Suppose we distinguish three states of a coin-- heads, tails and "on edge"-- then when a coin which was on edge falls over, that is an "event" leading to a change of state.

A reaction is one event which is triggered in some way by a previous event. (While this may occur through some process involving the physical base, there is no reason to pay attention here to possible details of this.)

Let us now look at some possible patterns of interest in reactive ecology.

A loop (the term is borrowed from computers) is a set of states and events that form a repeating sequence. (It need not repeat endlessly.) For instance, (if we let capital letters stand for states, and hyphens for events between,) the following would be a loop:

A - B - C - A - B - C - A - B - C

We might call a loop that repeats endlessly a "non-escape loop."

Many loops can be combined to produce more complex structures.

Now, very often there are some variable characteristics associated with a reactive system. For instance, "energy released in a change of state," or "amount of noise associated with an event," etc. If this variable increases with successive events, we call it escalation. Under certain circumstances, if we care to include the loop of events which cause the escalation in our description of the reactive structure, we call it positive feedback. (Damping, or negative feedback, occurs when some loop of events and states gradually reduces the variable.

We might also call an escalating loop an "increasing spiral," where the "up" dimension of the spiral corresponds to the variable, or we might follow common usage and call it a "vicious circle" (where "viciousness" refers to the increase of the variable.)

Another important patterning of reactive systems may be called "interlock," or the meshing of reactive structures. By the term "interlock" I wish to refer to the capacity of certain reactive structures to trigger each other in complicated and precise ways.

The best example of this sort of thing, in a way, was the old "Rube Goldberg device," occasionally drawn by that cartoonist. A Rube Goldberg device always had a purpose. It was a shaky scaffolding with many different strange mechanisms. It would accomplish its purpose in something like the following ways: A cat sees a picture of a dog and runs up a pole. The pole tilts, pivoting in the middle, and a foot attached to the other end of the pole kicks a bowling ball down a flight of stairs. The bowling ball breaks a string and then a goldfish bowl. The string drops a seend into a flowerpot and then the goldfish bowl waters it. When the flower blooms, a bull sees its redness and charges...

Crucial to the notion of interlock, here, is the orderly arrangement of elements which <u>might not be orderly</u> (and, were anyone to build the Rube Goldberg contraption, would assuredly not be.)

The notion of interlock may be clarified by an examination of ways in which the reactive structures might fail to produce an orderly process. (We will have to leave the term "orderly" undefined for the present.) Consider a family of acrobats attempting a complicated stunt: one that involves somersaults and flips onto a human pyramid. The stunt must be planned carefully, taking into account the condition of the human pyramid at any instant, the persons who are available to grab hold, the exact placement of all individuals and props in the act, and the exact timing of all moves and how they fit together. This is the interlock of the situation. (While skill, timing and careful watching may correct errors during the act within small limits, it is the interlock of the physical and timing aspects that determine whether the whole act, as a reactive structure, is feasible.) From this example we see that some interlocks are dependent on features in the physical base of the system, others depend on time. (We might call this time-dependent interlock.)

Let us look at a few psychological examples that may help clarify these concepts.

In the field of "ethology," a branch of conventional psychology, a number of workers have been studying the exact reactive structures of certain living creatures. For instance, it has been found that the herring gull and the stickleback (a fish) react in specific ways, or fail to react, to wooden models variously constructed to resemble their potential mates. These experiments have shown that a herring gull's mental picture of a herring gull is somewhat different from what our own tends to be. They have also shown that animal reactions to such stimuli tend to be complicated,

precise, and related in rather exact ways to the stimulating circumstances. (For this reason such behavior is often called "triggered" or "released," since the reactive structure involves a whole repertory of behaviors-- such as mating dances, ~~or~~ nest building, or fighting-- which do not appear to involve particular adjustments to the situation.)

A related example of interlock would be the interactions, for instance, of male and female herring gull, each having (it appears) a relatively fixed repertory of behaviors. Behavior 1 of the male triggers behavior 1 in the female,which in turn triggers behavior 2 in the male, and so on.

A reactive chain from everyday sociology is fairly simple. When a man holds a door for a ~~x~~ lady, she is quite likely to say "thank you" as she passes through, and he in his turn is rather likely to~~x~~ say, "You're welcome."

But in human behavior the interesting examples are going to be somewhat more complicated. While we will not go into them here, they will deal (for example) with individual habits and quirks, and fairly automatic and inevitable responses of individuals to their own or each other's behavior. This will include ~~xxxxxxxxxxxxxxx~~ everything from compulsions to reflex arcs.

Entire patternings of reactive interlock and ecology are discernible in the human sphere. ~~most of them would probably be~~ We could take this either from a case-history approach, which would probably be inhospitable to our basic point of view, or (for the present purposes,) from an expository and analytic approach

The "Vicious circle" is a term often used to describe such interactive patternings in human relationships. Another is "folie á deux," in which two people become confounded in an escalating deviant relationship. "Ménage a trois," similarly, refers to any threesome in which a special complementary rleationship has been set up.

An obvious important application of this terminology is to the psychology of individuals. However, it is also importantly applicable to the psychology of roles and complementary expaectations. Sociologists have given much attention to reciprocal behaviors and complementary roles. However, there has been lacking a systematic framework in which we could describe the interactions of individuals' chracteristics, roles and formalized behaviors, and informal roles. I believe that this can only be corrected by a descriptive framework embodying something very like this conceptual framework of reactive structure.

(Together with the Theory of Strategy, mentioned earlier, the model can be expanded to include situation aspects; and together with the Phenomenology described below, informal expectations.)

4. Systems analysis ~~may~~ might be defined as the examination of systems / interactions for an understanding of their interrelations and consequences.

The above definition seems to apply to "reactive ecology" as defined in the previous section.

Systems analysis might be defined as the examination of transactions, arrangements, procedures and processes for an understanding of their interrelations and consequences. Thus it is similar to, but distinct from, "reactive ecology" as defined in the previous section.

Reactive ecology may be considered a kind of systems analysis, that which deals ~~with~~ only with events and their inter-reactions. Systems analysis in the larger sense, as we will define it here, applies not merely to inter-reactions and consequences, but also to consonances and compatibilities.

Moreover, it may require ~~a~~ the investigation of the ~~physical~~ physical base of these inter-reactions and compatibilities.

Although the idea and origins of systems analysis had do with the design and maintenance of what we may call "operating systems," that is, systems which were designed for a purpose and are meant to continue operating to accomplish these purposes,

Let me define the term "operating system" to mean, then, any arrangement of elements, things or parts such as to produce sets of consequences over time. (I say "over time" to distinguish it from mere plans: it must either persist for awhile, or be repeated.)

'Systems Psychology' CARBON

NO DATE. Typewriter indicates March 1963 / 19.01.16